

Comparison of Exposure Factors
(Reflects changes adopted on April 28, 2005 Workgroup meeting)

Parameter	Symbol	Unit	MDNR Default	US EPA, 2002**	US EPA, 1991a	US EPA, 1991b	US EPA, 1989***	
							RME	CTE
Averaging Time for Carcinogen (C)	AT _c	year	70	70	70	70	70	70
Averaging Time for Non-Carcinogen (NC)	AT _{nc}	year	=ED	=ED	=ED	=ED	=ED	=ED
Body Weight:								
Resident Child	BW	kg	15	15	15	15	NA	16
Resident Adult	BW	kg	70	70	70	70	NA	70
Non-Residential Worker	BW	kg	70	70	70	70	NR not considered	
Construction Worker	BW	kg	70	70	CW not considered			
Exposure Duration:								
Resident Child	ED	year	6	6	6	6	6	9
Resident Adult	ED	year	24	24	24	24	24	
Non-Residential Worker	ED	year	25	25	25	25	NA [25]	NA [9]
Construction Worker	ED	year	1	Site-specific	CW not considered			
Exposure Frequency:								
Resident Child	EF	day/year	350	350	350	350	365 [350]	365 [350]
Resident Adult	EF	day/year	350	350	350	350		
Non-Residential Worker	EF	day/year	250	250 (225)	250	250	NA [250]	NA [219]
Construction Worker	EF	day/year	90	Site-specific	CW not considered			
Exposure Time for Dermal Contact with Groundwater:								
Resident Child	ET _d	hours/day	1	Superseded by RAGS, Part E (US EPA, 2004)				
Resident Adult	ET _d	hours/day	1					
Non-Residential Worker	ET _d	hours/day	1					
Construction Worker	ET _d	hours/day	1					
Event Frequency for Dermal Contact with Groundwater								
Resident Child	EV _{gw}	events/day	TBD	NA	NA	NA	NA [1]	NA [1]
Resident Adult	EV _{gw}	events/day	TBD	NA	NA	NA		
Non-Residential Worker	EV _{gw}	events/day	TBD	NA	NA	NA	NR not considered	
Construction Worker	EV _{gw}	events/day	TBD	NA	CW not considered			
Event Duration for Dermal Contact with Groundwater								
Resident Child	t _{event}	hr/event	TBD	NA	NA	NA	NA [1.0]	NA [0.33]
Resident Adult	t _{event}	hr/event	TBD	NA	NA	NA	NA [0.58]	NA [0.25]
Non-Residential Worker	t _{event}	hr/event	TBD	NA	NA	NA	NR not considered	
Construction Worker	t _{event}	hr/event	TBD	NA	CW not considered			
Event Frequency for Dermal Contact with Soil								
Resident Child	EV _{soil}	events/day	TBD	1	NA	NA	NA [1]	NA [1]
Resident Adult	EV _{soil}	events/day	TBD	1	NA	NA		
Non-Residential Worker	EV _{soil}	events/day	TBD	0 (1)	NA	NA	NA [1]	NA [1]
Construction Worker	EV _{soil}	events/day	TBD	1	CW not considered			

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Soil Ingestion Rate:								
Resident Child	IR _{soil}	mg/day	200	200	200	200	200	NA
Resident Adult	IR _{soil}	mg/day	100	100	100	100	100	NA
Non-Residential Worker	IR _{soil}	mg/day	100	50 (100)	50	50	NR not considered	
Construction Worker	IR _{soil}	mg/day	100	330	CW not considered			
Groundwater Ingestion Rate:								
Resident Child	IR _w	L/day	1	NA	NA	NA	NA	NA
Resident Adult	IR _w	L/day	2	2	2	2	2	1.4
Indoor Inhalation Rate (hourly)*:								
Resident Child	IR _{ai}	m ³ /hr	0.416	These documents use daily inhalation; hence, this parameter is not required.				
Resident Adult	IR _{ai}	m ³ /hr	0.833					
Non-Residential Worker	IR _{ai}	m ³ /hr	0.833					
Exposure Time for Indoor Inhalation:								
Resident Child	ET _{in}	hr/day	18	These documents use daily inhalation; hence, this parameter is not required.				
Resident Adult	ET _{in}	hr/day	18					
Non-Residential Worker	ET _{in}	hr/day	18					
Indoor Inhalation Rate (daily):								
Resident Child	IR _a	m ³ /day	7.5	20	NA	NA	NA	NA
Resident Adult	IR _a	m ³ /day	15.0	20	15	15	30	20
Non-Residential Worker	IR _a	m ³ /day	15.0	20	20	20	NR not considered	
Outdoor Inhalation Rate (hourly)*:								
Resident Child	IR _{ao}	m ³ /hr	0.416	These documents use daily inhalation; hence, this parameter is not required.				
Resident Adult	IR _{ao}	m ³ /hr	0.833					
Non-Residential Worker	IR _{ao}	m ³ /hr	0.833					
Construction Worker	IR _{ao}	m ³ /hr	0.833					
Exposure Time for Outdoor Inhalation:								
Resident Child	ET _{out}	hr/day	6	These documents use daily inhalation; hence, this parameter is not required.				
Resident Adult	ET _{out}	hr/day	6					
Non-Residential Worker	ET _{out}	hr/day	6					
Construction Worker	ET _{out}	hr/day	12					
Outdoor Inhalation Rate (daily):								
Resident Child	IR _a	m ³ /day	2.5	NA	NA	NA	NA	NA
Resident Adult	IR _a	m ³ /day	5.0	NA	15	NA	NA	NA
Non-Residential Worker	IR _a	m ³ /day	5.0	NA	NA	NA	NR not considered	
Construction Worker	IR _a	m ³ /day	10.0	20	CW not considered			
Skin Surface Area for Dermal Contact with Soil/Groundwater:								
Resident Child	SA	cm ² /day	2800	2800	NA	NA	NA [2800]	NA [2800]

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Resident Adult	SA	cm ² /day	5700	5700	NA	NA	NA [5700]	NA [5700]
Non-Residential Worker	SA	cm ² /day	3300	NA (3300)	NA	NA	NA [3300]	NA [3300]
Construction Worker	SA	cm ² /day	3300	3300	CW not considered			
Soil to Skin Adherence Factor:								
Resident Child	M	mg/cm ²	0.2	0.2	NA	NA	NA [0.2]	NA [0.04]
Resident Adult	M	mg/cm ²	0.07	0.07	NA	NA	NA [0.07]	NA [0.01]
Non-Residential Worker	M	mg/cm ³	0.2	NA (0.2)	NA	NA	NA [0.2]	NA [0.02]
Construction Worker	M	mg/cm ²	0.3	0.3	CW not considered			

Notes:

C: Carcinogen

CTE: Central tendency exposure

CW: Construction worker

NA: Not available

Values in **bold** are calculated as product of inhalation rate (hourly) and exposure time (hr/day)

*: Calculated dividing daily inhalation rate (10 m³/day for child and 20 cm³/day for adult) by 24 hours.

**: Values in () are exposure factors for outdoor worker.

***: Values in [] are exposure factors for dermal contact from US EPA's RAGS Part E (2004).

References:

US EPA, 1989. Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual, Part A. Office of Emergency and Remedial Response. December 1989. EPA/540/1-89/002.

US EPA, 1991a. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance "Standard Default Exposure Factors" Interim Final. Office of Emergency and Remedial Response. March 25, 1991. OSWER Directive 9285.6-03.

US EPA, 1991b. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part B Development of Risk-Based Preliminary Remediation Goals. Office of Emergency and Remedial Response. December 1991. EPA/540/R-92/003.

US EPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Emergency and Remedial Response. December 2002. OSWER 9355.4-24.

US EPA, 2004. Risk Assessment Guidance for Superfund Volume I; Human Health Evaluation Manual, Part E Supplemental Guidance for Dermal Risk Assessment. Office of Emergency and Remedial Response. July 2002. EPA/540/R/99/005, OSWER 9285.7-02EP.

NC: Non-carcinogen

RME: Reasonable maximum exposure

NR: Non-residential worker

TBD: To be determined